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(54) WATER-RESISTANT RECORDING MATERIAL FOR INKJET PRINTING

WASSERBESTÄNDIGES AUFZEICHNUNGSMATERIAL FÜR TINTENSTRAHLDRUCK

MATERIAU D'ENREGISTREMENT RESISTANT A L'EAU POUR IMPRESSION PAR JET D'ENCRE

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Description

The invention relates to a water-resistant recording material for inkjet printing, which has the character of paper and extremely high water resistance of the printed image and of the substrate material for the recording layer.

DE-A-30 18 342 A describes a synthetic paper for inkjet printing, which paper, after being printed on in the inkjet printer, is rendered transparent by means of heat in order to obtain multicolour inkjet recordings having high recording density, good colour reproduction and high water resistance. The print which initially appears pale acquires high contrast and water resistance only as a result of subsequent melting. Papers of this type then have the disadvantage of low opacity (high transparency) and that of the additional process step of the thermal aftertreatment.

DE-A-01 64 196 A discloses a recording layer for inkjet processes on a sheet-like base material which also includes papers of synthetic fibres, the layer containing both a cationic polymer and a polyvalent metal salt for fixing aqueous inks. In addition, water-penetrable or water-swellable binders, such as, for example, polyvinyl alcohol, and pigments, such as, for example, calcium carbonate, kaolin and urea/formaldehyde fillers may be present in such a layer. Owing to the choice of the components used (PVA; polyvalent metal salt; cationic polymer), the water resistance of the prints in the inkjet process is relatively low even if the water resistance test described (immersion for one minute in water followed by drying) is described as being positive. The aim of this application was primarily to produce a rapidly drying and stackable (non-offsetting) paper having a brilliant print.

DE-A-43 30 428 describes an inkjet recording sheet on which recordings having good water resistance can be produced. This is achieved using a water-resistant substrate, which may be a plastic film or a synthetic paper. In addition to finely divided porous pigment, the recording layer necessarily contains, as the main component, amphoteric ion latex of cationic colloid quality. DE-A-43 30 428 expressly states that, using conventional binders without this special synthetic polymer latex, the water resistance after printing is insufficient. Regarding the substrate material, it is stated that a synthetic paper of polypropylene, impregnated paper or plastic films are suitable.

JP-A-4-74685 relates generally to a recording material which can be printed on or written on in the moist state or on which copies can be produced in the wet state. The recording layer contains synthetic polymer latex, pigment, crosslinking agent and wax. The substrate material used is a material comprising cellulosic fibres and synthetic polymer fibres, so that the substrate becomes thermoplastic only at 180°C or at higher temperatures.

From EP-A-423 829 an aqueous ink recording sheet is known comprising a substrate sheet and an aqueous ink image receiving layer. The substrate is a paper which may contain a small amount of synthetic fibres and precipitated calcium carbonate and having a Stoechigt sizing degree of from 1 second to 15 seconds and having when soaked in water a ratio of the elongation in the machine direction to the elongation in the cross direction of 1.3:1 or less to avoid formation of curls and cockles in the recording sheet when printed with aqueous inks. The recording layer comprises fine particulate silica, polyvinyl alcohol resins as binder and a cationic polymeric material. Small amounts of synthetic polymeric latex material may be present in the recording layer.

GB-A-2 213 078 refers to an ink-jet recording sheet having a specific coating layer formed on a surface of a substrate sheet, which comprises a pigment and a resinous binder composed of a specific cationic copolymer and which may contain further different resinous binder. The substrate sheet may be a natural pulp paper, a polymeric film, synthetic pulp paper sheet, and synthetic fibre paper sheet.

For applications outdoors or in continuous contact with water, inkjet papers known to date are not suitable without further process steps, such as lamination with film, since the water resistance of the base papers and of the recording layer are not sufficient. It is precisely for applications such as, for example, building plans, maps, site plans, for example for divers, labels, sign plates and markings that inkjet prints which are mechanically stable and have unlimited colour stability even under the influence of water are required.

It is therefore the object of the present invention to provide a recording material for inkjet printing, which material is suitable for outdoor use, including underwater use, and resists any kind of influence by humidity or water. Both mechanical strength of the substrate paper under the influence of water and water resistance of the inkjet image are required for this purpose. Furthermore, a brilliant, high-contrast, coloured or black inkjet print having high resolution and very crisp edges is required.

According to the invention this object is achieved by a water-resistant recording material for the ink-jet process using water-based inks, having a substrate paper containing from 10% by weight to 90% by weight cellulosic fibres and from 1% by weight to 40% by weight of synthetic fibres and from 50% by weight to 5% by weight (all percentages are based on total weight of the substrate paper) of binder selected from polyvinyl acetate, polyvinyl acetate copolymers, styrene/butadiene copolymers. styrene/butadiene/acrylonitrile terpolymers, styrene/(meth)acrylate copolymers, (meth)acrylic polymers, ethylene/(meth)acrylic acid copolymers and having a recording layer or layers which is (are) arranged on one or both main surfaces of the substrate paper, which layer or layers has (have) a basis weight of 10 g/m^2 to 50 g/m^2 and contain(s) highly porous abrasion-resistant pigment and polymer dispersions having a minimum film formation temperature between -20°C and +50°C. and if desired additionally water-soluble binders selected from polyvinyl alcohol, polyvinylpyrrolidone, starch, starch derivatives and/or a crosslinking agent for the binder, and after storage for

24 hours at 23°C in water the recording material has over 80% of the tear strength of the dry recording material, measured according to DIN 53128, and the colour difference ΔE, measured according to DIN 6174, of areas of the primary colours applied to the recording layer in the ink-jet process is <10, based on the initial colour values.

In addition to the binder or binders, the substrate paper preferably also contains fillers and/or pigments, the binder content being correspondingly reduced as a result of their presence. Suitable pigments are kaolin, barium sulphate, calcium carbonate, calcium sulphate and TiO_2. The pigment/filler content may be 2.0% by weight to 30% by weight based on the total weight of the substrate paper. The wet strength of the substrate paper can be tailored to the requirements by the concomitant use of crosslinking agents for the binder and/or wet strength agents. The binders are selected from polyvinyl acetate, polyvinyl acetate copolymers, styrene/butadiene copolymers, styrene/butadiene/acrylonitrile terpolymers, styrene/(meth)acrylate copolymers, (meth)acrylic polymers, ethylene/(meth)acrylic acid copolymers. Such film-forming polymers are commercially available.

For example, melamine/formaldehyde resins or urea/formaldehyde resins may be used as crosslinking agents. The substrate paper is produced on conventional paper machines by known processes and provided with the binder, preferably in the size press and/or by subsequent coating in a conventional coating machine. For example, polyamide fibres, polyester fibres, viscose fibres or mixtures thereof may be present as synthetic fibres in the substrate paper. The basis weight of the substrate paper may be 50 g/m^2 to 300 g/m^2, preferably 80 g/m^2 to 200 g/m^2.

Owing to the low absorptivity of the paper for water-based inks, direct printing by means of an inkjet printer gives a poorly drying and blurred image which is not water resistant. The substrate paper itself has excellent water resistance, which is manifested by a high tear strength in the completely wet state.

A water-resistant recording layer is therefore applied to one side or both sides of this paper. This said recording layer contains binder, pigment(s), preferably dye fixing compositions, and further conventional auxiliaries.

Surprisingly, it was found that the combination of the special paper which contains synthetic fibres with coatings based on highly porous finely divided pigments leads to an abrasion-resistant and extremely water-resistant paper which, even, for example, after storage in water for 24 hours, retains its strength and shows the image information without abrasion, virtually without loss of contrast.

The recording layer applied to the synthetic base paper results in rapid ink absorption and in fixing of the dyes contained in the printing ink. Furthermore, this coating must have excellent adhesion to the base paper, both in the wet and in the dry state. The coating itself must have high cohesion so that mechanical stress due to flexing, pleating, folding or rubbing, both in the wet and in the dry state, does not damage the layer or the printed image.

In order to ensure good absorptivity for water-based inks, porous pigment, in particular silica, is preferably used in the recording layer. Suitable pigments have a surface area (measured according to BET) of over 200 m^2/g. Suitable pigments are, for example, precipitated silica particles having a mean particle size of between 1 µm and 20 µm, preferably between 4 µm and 12 µm, and the abovementioned BET surface area.

Water-soluble, cationic polymers having a high content of quaternary ammonium groups and which becomes water insoluble upon drying of the recording layer are preferably present in the recording layer in order to fix the ink dyes. Quaternary polyacrylates, polydiallyldimethylammonium chloride, cationically modified polystyrene, cationically modified starch, cationically modified polyvinyl alcohol, quaternary polyethyleneimine, quaternary polyvinylpyridine and copolymers of these compounds with one another or with other nonionic or anionic monomer units are suitable. 0.1 to 1 part of cationic polymer is preferably added per part of porous pigment.

In order to obtain a particularly water-resistant layer, it is expedient to choose for the pigment a binder which can no longer be superficially dissolved by water after the generally water-based coating has dried. Polymer dispersions, such as, for example, vinyl acetate homo- or copolymers, acrylate (co)polymers, styrene/butadiene copolymers, ethylene copolymers or vinyl chloride copolymers have proved suitable for this purpose. In order to ensure the flexibility of the layer and adhesion to the paper, dispersions having a minimum film formation temperature between -20°C and +50°C, preferably between -10°C and +20°C, are used. Water-soluble binders, such as, for example, polyvinyl alcohol, polyvinylpyrrolidone, starch or starch derivatives, may additionally be used. In order further to increase the water resistance, crosslinking agents which react during drying of the layer may be incorporated into the coating solution. Suitable substances are urea/formaldehyde or melamine/formaldehyde resins, aziridines, polyfunctional isocyanates and boric acid (for PVA).

Optical brighteners, wetting agents, further pigments, for example aluminium hydroxides or aluminium oxides, kaolin, calcium carbonate, dyes, adhesion promoters, antifoams, thickeners, dispersants, etc., may also be present as auxiliaries in the layer.

The ink absorption layer is applied to the synthetic paper with the aid of conventional coating processes, for example by roller application and metering by means of an air brush or rotating doctor blade, preferably from aqueous dispersion, and is dried by means of hot air. The coating weight of the dried coating is between 10 and 50 g/m^2, preferably 15 to 30 g/m^2. This coating weight is necessary in order to permit rapid absorption of the ink liquid into the coating during printing and thus to prevent blurring of the image lines. The coating weight may be varied depending on the printer and amount of ink.

The ink absorption layer of the present invention exhibits excellent adhesion to the synthetic base paper and has good cohesion and flexibility, so that it withstands any mechanical stresses both in the dry and in the wet state. The coating is thus resistant to flexing, folding and abrasion; furthermore, the layer cannot be damaged in the layer adhesion test by means of a self-adhesive tape, similar to the crosshatch test.

The coated paper has high resistance to mechanical stress, i.e. initial tearing and complete tearing of the paper are possible only with the use of great force, both in the dry and in the wet state. In particular, in the completely wet state, the paper has over 80% of the tear strength of the dry paper, measured according to DIN 53128.

The paper according to the present invention can, using commercial inkjet printers, be printed with a high-contrast image which has crisp edges and high resolution and may be coloured in the case of colour printers. The paper absorbs the generally water-based ink rapidly into the coating and is dry and non-smudging shortly after printing. Suitable printers are, for example, printers which operate according to the bubblejet principle or piezoelectric principle, as are available in various versions, for example from the companies Canon, Epson, Hewlett Packard, etc. Both small-format (DIN A3 and A4) and large-format prints, for example rolls for posters, are possible. The inks used in the abovementioned printers contain, as a rule, further auxiliaries, such as, for example, high boilers (glycols, NMP, etc.) and wetting agents, in addition to water and anionic dyes.

The water-soluble anionic dyes of these inks are fixed in the coating by ionic interaction with the cationic fixing agents so strongly that the printed image becomes extremely water-resistant. The printed image is also very resistant to flexing, pleating, folding and scratching, both in the wet and in the dry state, so that the image information has unlimited stability even under extreme environmental conditions. Inks which have high lightfastness even against UV light are preferably chosen for image production. Owing to the fixing of the dyes and the water resistance of the coating itself, the material withstands the action of water even over long periods. Thus, the colour intensity (contrast) of the printed image decreases only slightly, if at all, during storage for 24 hours in water at 23°C. In any case, the colour stability under these conditions is so good that, after this treatment, the colour difference ΔE of coloured areas of the primary colours black, cyan, magenta, yellow, blue, red and green is less than 10, based on the initial colour values.

Test methods:

Tear strength of the wet paper and resistance of the printed image

A test image which contains in particular large coloured areas of all primary colours (cyan, magenta, yellow and black) and of the binary mixed colours (blue, green, red) is applied to the water-resistant inkjet paper by means of an inkjet printer. 10 minutes after production of the test image, the recording sheet is immersed completely in water at 23°C for 24 hours. After this storage time, the mechanical strength of the paper in the wet state in the longitudinal and transverse directions is determined according to DIN 53128 (tear strength). The tear strength of the dry paper conditioned at 23°C and 50% relative humidity is also determined.

Furthermore, the paper stored in water for 24 hours is dried in a drying oven at 80°C for 5 minutes. As was done directly after the test printing, the colour location, in Cielab coordinates, of each coloured area is then determined by means of a colorimeter according to DIN 6174. The colour difference ΔE, calculated from the measurements before and after storage of the particular coloured area in water, is a measure of the discoloration of the printed areas or fixing of the dyes of the inkjet inks.

Example 1

A commercial synthetic 140 g/m^2 paper consisting of 61% of cellulosic fibres, 4% of synthetic fibres, 12% of synthetic binders and auxiliaries is coated with the following coating composition with a coating weight (dry solids) of 25 g/m^2 by means of a rotating doctor blade and is dried in a drying oven at 100°C for 5 minutes.

- Water	600 g
- Precipitated silica FK 320 DS (Degussa)	80 g
- Poly(diallyldimethylammonium) chloride having an average molecular weight of 75,000	10 g
- Vinyl chloride/vinyl acetate copolymer dispersion (50% solids content)	90 g
- Wetting agent	2.5 g
- Polyvinyl alcohol Mowiol 4/88 (Hoechst), 10% strength solution	225 g

(continued)

- Ammonia (25% solids content)	7 g

The coating composition has a solids content of 15.8% and a pH of 8.0.

The paper coated in this manner is printed with a test print by means of a Canon BJC 800 inkjet printer with associated ink cartridges. It has extremely high water resistance: the image-bearing paper stored in water for 24 hours at 23°C has a tear strength of 3.16 N longitudinally and of 3.64 N transversely, compared with 1.6 N longitudinally and 2.0 N transversely in the dry state.

The coloured areas show only very little or no colour changes compared with the initial colour values as a result of the treatment:

	ΔE
Black:	0.9
Cyan:	5.0
Magenta:	6.5
Yellow:	8.1
Blue:	1.3
Green:	2.1
Red:	4.7

After this treatment, the print exhibits a high-contrast, high-resolution image having crisp edges and shows no visible change.

Claims

1. Water-resistant recording material for the ink-jet process using water-based inks, having a substrate paper containing from 10% by weight to 90% by weight cellulosic fibres and from 1% by weight to 40% by weight of synthetic fibres and from 50% by weight to 5% by weight (all percentages are based on total weight of the substrate paper) of binder selected from polyvinyl acetate, polyvinyl acetate copolymers, styrene/butadiene copolymers, styrene/butadiene/acrylonitrile terpolymers, styrene/(meth)acrylate copolymers, (meth)acrylic polymers, ethylene/(meth)acrylic acid copolymers and having a recording layer or layers which is (are) arranged on one or both main surfaces of the substrate paper, which layer or layers has (have) a basis weight of 10 g/m^2 to 50 g/m^2 and contain(s) highly porous abrasion-resistant pigment and polymer dispersions having a minimum film formation temperature between -20°C and +50°C, and if desired additionally water-soluble binders selected from polyvinyl alcohol, polyvinylpyrrolidone, starch, starch derivatives and/or a crosslinking agent for the binder, and after storage for 24 hours at 23°C in water the recording material has over 80% of the tear strength of the dry recording material, measured according to DIN 53128, and the colour difference ΔE, measured according to DIN 6174, of areas of the primary colours applied to the recording layer in the ink-jet process is <10, based on the initial colour values.

2. Water-resistant recording material according to claim 1,
characterized in that
the substrate paper contains polyamide fibres, polyester fibres, viscose fibres or mixtures thereof as synthetic fibres.

3. Water-resistant recording material according to claim 1 or 2,
characterized in that
the recording layer contains a polymeric binder and 10% by weight to 70% by weight, based on the total layer weight, of silica.

4. Water-resistant recording material according to any of claims 1-3,
characterized in that

the polymer dispersions having a minimum film formation temperature from -20°C to +50°C are selected from polyvinyl acetate, polyvinyl acetate copolymers, styrene/butadiene copolymers, styrene/butadiene/acrylonitrile terpolymers, styrene/(meth)acrylate copolymers, (meth)acrylic polymers, ethylene/(meth)acrylic acid copolymers, ethylene copolymers or vinyl chloride copolymers or mixtures thereof.

5. Water-resistant recording material according to claim 1, **characterized in that** the recording layer contains a polymeric cationic fixing agent for aqueous inks.

6. Water-resistant recording material according to claim 5, **characterized in that** the polymeric cationic fixing agent is modified polystyrene, a cationic (meth)acrylate copolymer, a quaternary polyimine, poly(diallyldimethylammonium) chloride or a mixture thereof.

7. Use of the water-resistant recording material according to any of claims 1 to 6 for recordings by the ink-jet process using inks containing water-soluble dyes.

Patentansprüche

1. Wasserfestes Aufzeichnungsmaterial für das Tintenspritzverfahren mit wäßrigen Tinten mit einem Papierträger, enthaltend 10 Gew.-% bis 90 Gew.-% Cellulosefasern und 1 Gew.-% bis 40 Gew.-% synthetische Fasern und 50 Gew.-% bis 5 Gew.-% (alle Prozentangaben beziehen sich auf Gesamtgewicht des Papierträgers) Bindemittel, ausgewählt aus Polyvinylacetat, Polyvinylacetatcopolymeren, Styrol-Butadien-Copolymeren, Styrol-Butadien-Acrylnitrilterpolymeren, Styrol-(Meth)acrylat-Copolymeren, (Meth)acrylpolymeren, Ethylen-(Meth)acrylsäure-Copolymeren, und einer Aufzeichnungsschicht oder -schichten, die auf einer oder beiden Hauptoberfläche(n) des Papierträgers angeordnet ist (sind), wobei die Schicht oder Schichten ein Auftragsgewicht von 10 g/m^2 bis 50 g/m^2 hat (haben) und hochporöses, abriebbeständiges Pigment und Polymerdispersionen mit einer Mindestfilmbildungstemperatur zwischen -20° C und +50° C enthält (enthalten), und gegebenenfalls zusätzlich wasserlösliche Bindemittel, ausgewählt aus Polyvinylalkohol, Polyvinylpyrrolidon, Stärke, Stärkederivaten, und/oder ein Vernetzungsmittel für das Bindemittel, und das Aufzeichnungsmaterial nach 24 Stunden Lagerung bei 23° C in Wasser mehr als 80 % der Reißfestigkeit des trockenen Aufzeichnungsmaterial, gemessen nach DIN 53128, aufweist und der Farbabstand ΔE, gemessen nach DIN 6174, von im Tintenstrahlverfahren auf die Aufzeichnungsschicht aufgebrachter Farbflächen der Grundfarben, bezogen auf Ausgangsfarbwerte, <10 ist.

2. Wasserfestes Aufzeichnungsmaterial nach Anspruch 1, dadurch gekennzeichnet, daß das Trägerpapier Polyamidfasern, Polyesterfasern, Viskosefasern oder Mischungen derselben als synthetische Fasern enthält.

3. Wasserfestes Aufzeichnungsmaterial nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Aufzeichnungsschicht ein Polymerbindemittel und 10 Gew.-% bis 70 Gew.-%, bezogen auf Gesamtschichtengewicht, an Siliciumdioxid enthält.

4. Wasserfestes Aufzeichnungsmaterial nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Polymerdispersionen mit einer Mindestfilmbildungstemperatur von -20° C bis +50° C ausgewählt sind aus Polyvinylacetat, Polyvinylacetatcopolymeren, Styrol-Butadien-Copolymeren, Styrol-Butadien-Acrylnitrilterpolymeren, Styrol/(Meth)acrylat-Copolymeren, (Meth)acrylpolymeren, Ethylen/(Meth)acrylsäure-Copolymeren, Ethylencopolymeren oder Vinylchloridcopolymeren oder Mischungen derselben.

5. Wasserfestes Aufzeichnungsmaterial nach Anspruch 1, dadurch gekennzeichnet, daß die Aufzeichnungsschicht ein polymeres kationisches Fixiermittel für wäßrige Tinten enthält.

6. Wasserfestes Aufzeichnungsmaterial nach Anspruch 5, dadurch gekennzeichnet, daß das polymere kationische Fixiermittel modifiziertes Polystyrol, ein kationisches (Meth)acrylatcopolymer, ein quaternäres Polyimin, Poly(diallyldimethylammonium)chlorid oder eine Mischung derselben ist.

7. Verwendung des wasserfesten Aufzeichnungsmaterials nach einem der Ansprüche 1 bis 6 für Aufzeichnungen nach dem Tintenspritzverfahren mit wasserlösliche Farbstoffe enthaltenden Tinten.

Revendications

1. Matière d'enregistrement résistante à l'eau pour le procédé à jet d'encre utilisant des encres à base d'eau, possédant un substrat en papier contenant de 10% en poids à 90% en poids de libres cellulosiques et de 1% en poids à 40% en poids de libres synthétiques et de 50% en poids à 5% en poids (tous les pourcentages sont basés sur le poids total du papier substrat) d'un liant choisi parmi le poly(acétate de vinyle), les copolymères poly(acétate de vinyle), les copolymères styrène/butadiène, les terpolymères styrène/butadiène/acrylonitrile, les copolymères styrène/(méth)acrylate, les polymères (méth)acryliques, les copolymères éthylène/acide (méth)acryliques et possédant une (ou des) couche(s) d'enregistrement qui est (sont) disposée(s) sur une ou les deux surfaces principales du substrat papier, la (ou les)dite(s) couche(s) qui possède(nt) un grammage de 10 g/m^2 à 50 g/m^2 et contien(nen)t un pigment fottement poreux résistant à l'abrasion et des dispersions de polymères possédant une température de formation de film minimale comprise entre -20°C et +50°C, et, si souhaité, des liants hydrosolubles supplémentaires choisis parmi le poly(alcool vinylique), la polyvinylpyrrolidone, l'amidon, les dérivés d'amidon et/ou un agent de réticulation pour le liant, et après stockage pendant 24 heures à 20°C dans l'eau, la matière d'enregistrement possède plus de 80% de la résistance au déchirement de la matière d'enregistrement sèche, mesurée selon DIN 53128, et la différence de couleur ΔE, mesurée selon DiN 6174, de zones de couleurs primaires appliquées à la couche d'enregistrement dans le procédé à jet d'encre est inférieure à 10, par rapport aux valeurs initiales.

2. Matière d'enregistrement résistante à l'eau selon la revendication 1, caractérisée en ce que le papier substrat contient des fibres de polyamide, des fibres de polyester, des fibres de viscose ou leurs mélanges en tant que fibres synthétiques.

3. Matière d'enregistrement résistante à l'eau selon l'une des revendications 1 ou 2, caractérisée en ce que la couche d'enregistrement contient un liant polymère et 10% en poids à 70% en poids, par rapport au poids total de la couche, de silice.

4. Matière d'enregistrement résistante à l'eau selon l'une des revendications 1 à 3, caractérisée en ce que les dispersions de polymères possédant une température minimale de formation de film de -20°C à +50°C sont choisies parmi le poly(acétate de vinyle), les copolymères de poly(acétate de vinyle), les copolymères styrène/butadiène, les terpolymères styrène/butadiène/acrylonitrile, les copolymères styrène/(méth)acrylate, les polymères (méth)acryliques, les copolymères éthylène/acide (méth)acryliques, les copolymères d'éthylène ou les copolymères de chlorure de vinyle ou leurs mélanges.

5. Matière d'enregistrement résistante à l'eau selon la revendication 1, caractérisée en ce que la couche d'enregistrement contient un agent de fixation polymère cationique pour les encres aqueuses.

6. Matière d'enregistrement résistante à l'eau selon la revendication 5, caractérisée en que l'agent de fixation polymère cationique est un polystyrène modifié, un copolymère de (méth)acrylate cationique, une polyimine quaternaire, un poly(chlorure de diallyldiméthylammonium) ou leurs mélanges.

7. Utilisation de la matière d'enregistrement selon l'une des revendications 1 à 6 pour des enregistrements à l'aide du procédé à jet d'encre en utilisant des encres contenant des colorants hydrosolubles.

Silice	8 Cg	50%
~~Al$_2$O$_3$~~	0 g	
PVOH	2 3g	14%
PVAC	~~4,5 g~~	25%
poly DADMAC	1 0g	
	15 g	